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THE EFFICIENCY OF HALOGENS IN INDUCING METAMORPHOSIS IN FROG LARVAE<sup>1</sup>

GUDERNATSCH has shown in his interesting and important experiments on the effect of feeding larval frogs upon the substance of certain glands with internal secretions, that thyroid accelerates metamorphosis to a marked degree. Inasmuch as the present writer has been studying the involution of the organs of the tadpole during metamorphosis, Gudernatsch's results were of significance and opened at once the question as to what component of the thyroid exerted this accelerating effect. To the solution of this problem I turned my attention during the past summer, hoping that data would be found to aid in interpreting the observations which have already been made upon the physiological processes involved during metamorphosis.

Attention was first directed to the thyroid constituents. All of the iodin-bearing portions of the gland substance gave positive results, while the nucleoprotein, lipoid and other fractions were negative. The negative results given by feeding lipoid is significant in the light of the theory of von Fürth that cholin is responsible for the vaso-motor effects of thyroid; for the lipoid-free thyroid substance gave positive results, showing that cholin, which is present in thyroid only in the lecithins, is not functional in a vaso-motor capacity in inducing the different changes in the metamorphosing tadpole. Other evidence, such as ligation of the chief blood-vessels of the tail previous to and during involution, which does not affect the rate of tissue absorption, points to the fact that blood changes are not responsible for metamorphosis.

Iodin seems to be associated in the thyroid with a globulin which Oswald has called thyreoglobulin, which, on hydrolysis, is reducible to a mass called iodothyronin by Baumann; this is a mixture of end-products of protein disintegration and especially of amino-acids, some of which, such as tryptophan and tyrosin, probably hold the iodin in some sort of association, but in what way is

not known at present. Now in the present set of experiments, thyreoglobulin, iodothyronin and an iodated amino-acid, tyrosin (3, 5, diodo-tyrosin), gave positive results when fed separately to the larvae. The tyrosin used was from a pancreatic digest and after recrystallization it was iodated at 0° C. with resublimed iodin scales.

Other iodin compounds, not derived from the thyroid, were examined. Starch iodate, marine iodin-bearing algae, iodated hen's egg lecithin and all of the inorganic iodides tried gave negative results. Iodated Witte Peptone gave positive results, quite comparable in every way with those obtained with thyroid. Inasmuch as only "organic" iodin gave positive results and then only when associated with proteins, the conclusion seems to be warranted that the iodin, in order to be available, must be in some way associated with amino-acids. The iodin of the plant material is known not to be in the same form as in thyroid, for in algae it is always associated with potassium, probably as KI; therefore the plant iodin is not an exception.

Two theories may be proposed to account for this effect of iodin: (1) If the process of involution is due to phagocytosis as Metchnikoff, Mercier and many others believe, we have a basis for the accelerating action of iodin in the work of Marbé, who has shown that organic iodin preparations raise the opsonic index of blood of mammals. (2) If, as the work of Loss and of the present writer<sup>2</sup> up until the present time seems to show, the process concerns, initially, at least, some factor other than phagocytosis, and that probably it is a matter of autolysis, then we may resort to the results obtained by Kepinow, where iodin accelerates that process. In all probability, the rôle of iodin is two-fold, that is, instigating and accelerating autolysis in the first place, and secondly, favoring phagocytosis. While we do not know certainly what relation exists between the destructive changes, collectively designated involutionary and those concerned with differentiation, results obtained by the

<sup>1</sup> The complete details of this work are published in another journal (*Jour. Biol. Chem.*, Vol. 19, 110-13).

<sup>2</sup> *Proc. Soc. Exp. Biol. and Med.*, Vol. 11, p. 184; *idem.*, Vol. 10, p. 31; *Amer. Jour. Physiol.*, December, 1914.

writer point to the invariable precedence of the former, so that these may set up processes of differentiation.

M. MORSE

MADISON, WIS.,

September 25, 1914

*SOCIETIES AND ACADEMIES*

*BOTANICAL SOCIETY OF WASHINGTON*

THE ninety-eighth regular meeting of the Botanical Society of Washington was held in the assembly hall of the Cosmos Club at 8 P.M., October 6, 1914. Forty members and two guests were present. The following scientific program was given:

Mr. P. H. Dorsett, "The Botanical Garden of Rio de Janeiro, Brazil" (with lantern).

Mr. W. F. Wight, "Andean Origin of the Cultivated Potato" (with lantern and specimens).

Both papers are to be published elsewhere.

The fourteenth annual meeting of the Botanical Society of Washington was held at 1:30 P.M., October 23, 1914, with twenty-nine members present. The customary reports were presented and approved and the following officers were elected for the ensuing year: Dr. R. H. True, president; Mr. G. N. Collins, vice-president; Professor C. E. Chambliss, recording secretary; Dr. Perley Spaulding, corresponding secretary; Mr. H. C. Gore, treasurer, and Mr. W. E. Safford, vice-president to the Washington Academy of Sciences.

The ninety-ninth regular meeting of the Botanical Society of Washington was held in the assembly hall of the Cosmos Club at 8 P.M., November 3, 1914. Forty-nine members and three guests were present. Mr. Wilson Popenoe was unanimously elected to membership. The scientific program was:

Mr. Paul Popenoe, "The Date Palm in Antiquity" (with lantern).

The speaker referred particularly to the influence of the date palm on the religion of the Semitic peoples. Prized for the food and drink it furnished, it was revered because of the mystery of sex emphasized by its monœciousness, and became identified with the primitive mother goddess of fertility. A sacred palm in a garden at Eridu, near the mouth of the Euphrates River, is thought by many investigators to be the origin of the Tree of Life of the Garden of Eden, described in Genesis. The culture of the palm was thoroughly known at a very early period, the Babylonian inscriptions giving reason to believe that it was more skilful 1900 years B.C. than it is in that region 1900 years A.D.

Mr. W. E. Safford, "The Economic Plants of Ancient Peru."

This paper was based upon collections and observations made by the writer while cruising along the Peruvian and Chilian coast, in 1887, and while acting as commissioner for the World's Columbian Exposition to Peru and Bolivia, in 1891 to 1893. Prehistoric graves were opened at Caldera, Iquique, Arica, the Rimac Valley, Ancon, Chimbote, Truxillo, and the vicinity of Payta. The material obtained is mainly in the Field Columbian Museum at Chicago and the United States National Museum. In addition to objects of ethnological interest many articles were found illustrating the ethnobotany of Ancient Peru. Not only were seeds, seed-pods, dried fruits, leaves and tubers found, but beautiful representations of many of the food plants in terra-cotta, in the form of funeral vases, were discovered in graves near the coast, especially at Chimbote and Truxillo. Among these were a number not included in Wittmaack's list published in Reis & Stuebel's great work "Das Todtenfeld von Ancon." Beautiful models in terra-cotta of the tubers of *Solanum tuberosum* were found, also of the fruits of *Solanum muricatum* and *Lucuma obovata*, and most interesting of all the almond-like kernels of *Caryocar amygdaliforme* R. & P., easily distinguished by their protruding recurved embryo. Another interesting object was a terra-cotta vase representing the roots of the achira (*Canna edulis*). The collections include specimens of *Phaseolus vulgaris* and *Phaseolus lunatus*, a gourd full of peanuts (*Arachis hypogaea*) and models of the same on terra-cotta vases; mandioca roots and models of the latter; quantities of maize and models of the same on funeral vases; bags of coca leaves (*Erythroxylum Coca*), and specimens of raw cotton, dark brown, light brown and white, together with spindles with cotton yarn upon them; looms with half-woven fabrics and textiles of beautiful and intricate designs. Among the most interesting of the funeral vases were forms representing the corn god of ancient Peru, a monster with protruding tusks, surrounded by ears of maize; and the god of agriculture, represented with a stalk of maize in one hand and a stalk of mandioca in the other, with a cluster of roots at the base very much like those of a dahlia.

The paper was illustrated by numerous slides, principally of objects in the collection of the Field Columbian Museum.

PERLEY SPAULDING,  
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